

**BULLETIN 105.**

**APRIL, 1897.**

**Ontario Agricultural College and Experimental Farm**

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# **INSTRUCTIONS IN SPRAYING.**

**By J. H. PANTON,**

**PROFESSOR OF BIOLOGY, ONTARIO AGRICULTURAL COLLEGE.**

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# THE ONTARIO AGRICULTURAL COLLEGE

AND

## EXPERIMENTAL FARM, GUELPH, ONT.

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## BULLETIN No. 105.

### INSTRUCTIONS IN SPRAYING.

By J. HOYES PANTON, PROFESSOR OF BIOLOGY, ONTARIO AGRICULTURAL COLLEGE.

#### SOLUTIONS RECOMMENDED.

##### 1. BORDEAUX MIXTURE.

Copper sulphate .....	4 pounds.
Lime (fresh) .....	4 "
Water .....	40 gallons.

Suspend the copper sulphate in five gallons of water. This may be done by putting it in a bag of coarse material, and hanging it so as to be covered by the water. Slake the lime in about the same quantity of water. Then mix the two and add the remainder of the 40 gallons of water.

Warm water will dissolve the copper sulphate more readily than cold water. If the lime is at all dirty strain the lime solution.

If the lime is good the above amount is likely to be sufficient. It is an easy matter to know how much lime is required by using what is termed the ferrocyanide of potassium test. This substance can be got at any druggist's, and very little is required. Take a small bottle (2 oz.) and get it filled with a saturated solution of this compound. If there is not plenty of lime in your mixture, a drop of the test added to it, turns brown. Add more lime and stir. As soon as the test fails to color in coming in contact with your mixture, it indicates there is sufficient lime present to neutralize the effects of the copper sulphate. Use wooden vessels in preparing the Bordeaux mixture.

##### 2. AMMONIACAL COPPER CARBONATE SOLUTION ("Cupram").

Copper carbonate .....	1 ounce.
Ammonia sufficient to dissolve the copper carbonate.	
Water .....	10 gallons.

This solution is not much used, and is recommended only in cases where the fruit is so far advanced that it would be disfigured by using the Bordeaux mixture.

## 3. PARIS GREEN MIXTURE.

Paris green .....	1 pound.
Water .....	200 to 300 gallons.

Use 200 gallons of water in a mixture for apple trees, 250 for plum trees, and 300 for peach trees. When Paris green is added to Bordeaux mixture, so as to form a combined insecticide and fungicide, add four ounces to every 40 gallons of the Bordeaux mixture.

## 4. HELLEBORE.

White hellebore (fresh) .....	1 ounce.
Water .....	3 gallons.

## 5. PYRETHRUM.

Pyrethrum powder (fresh) .....	1 ounce.
Water .....	4 gallons.

## 6. KEROSENE EMULSION.

Hard soap .....	$\frac{1}{2}$ pound, or soft soap, 1 quart.
Boiling water (soft) .....	1 gallon.
Coal oil .....	2 gallons.

After dissolving the soap in the water, add the coal oil and stir well for 5 to 10 minutes. When properly mixed, it will adhere to glass without oiliness. A syringe or pump will aid much in this work. In using, dilute with from 9 to 15 parts of water. Kerosene emulsion may be prepared with sour milk (1 gallon), and coal oil (2 gallons), no soap being required. This will not keep long.

## NOTES.

1. When there is danger of disfiguring fruit with the Bordeaux mixture use the ammoniacal copper carbonate solution.

2. Experience in spraying during the past two years indicates that it is best to use the combined insecticide and fungicide, commencing as soon as the buds begin to swell, again when the leaves appear, and continue it at intervals of 10 to 15 days, until the trees have been sprayed 3 to 5 times, which will depend upon the weather. In the case of a rainy season, it may be necessary to spray at least five times, while if dry, and the mixtures have been allowed to remain on the foliage, then three or four times may be sufficient.

In no case spray while the trees are in bloom, but immediately after. It is contrary to law.

3. The combined insecticide and fungicide, containing Paris green and Bordeaux mixture, is to be used for insects that chew, and injurious fungi, but kerosene emulsion alone for those insects that suck the juices of plants, such as aphids, thrips, red spider, oyster shell bark louse, etc.

4. A stock solution for the preparation of Bordeaux mixture may be prepared as follows: Dissolve 25 pounds of copper sulphate in 25 gallons of water. One gallon of this contains one pound of the copper sulphate. In another barrel slake 25 pounds of good lime, and add  $12\frac{1}{2}$  gallons of water. One gallon of this contains two pounds of lime. To make the mixture, take four gallons of the copper sulphate solution and two of the lime. If there is any doubt about there not being sufficient lime try the test already referred to under Bordeaux mixture. Now fill up the amount to 40 gallons with water.

5. Prepare the mixtures well, apply them at the proper time, and be as thorough as possible in the work.

## TREATMENT.

### 1. APPLE.

Treatment for destroying *codling moth*, *bud moth*, *tent caterpillar*, *canker worm*, *apple spot* and *leaf blight*.

First spraying: Bordeaux mixture and Paris green (4 oz. to the barrel of the mixture) when the buds are swelling.

Second spraying: Bordeaux mixture and Paris green before the blossoms open.

Third spraying: Bordeaux mixture and Paris green when the blossoms have fallen.

Fourth and fifth spraying: Bordeaux mixture and Paris green at intervals of ten to fifteen days, if necessary.

### 2. PEAR.

*Leaf blight*, *scab* and *codling moth*, the same treatment as for the apple.

### 3. PLUM.

*Curculio*, *brown rot* and *leaf blight*.

First spraying: Bordeaux mixture before the flower buds open.

Second spraying: Bordeaux mixture and Paris green as soon as the petals have fallen.

Third spraying: Bordeaux and Paris green in seven to ten days after.

Fourth spraying: Bordeaux mixture in ten to fifteen days after.

### 4. PEACH.

*Brown fruit rot*, *leaf blight* and *plum curculio*.

First and second sprayings: Same as for the treatment of the plum.

Third spraying: Bordeaux mixture in two to three weeks.

Fourth spraying: Ammoniacal copper carbonate if any danger of disfiguring the fruit with Bordeaux mixture.

## 5. CHERRY.

*Aphis, slug, brown rot and leaf blight.*

First spraying: Bordeaux mixture as the buds are breaking; if the *aphis* appears use kerosene emulsion alone.

Second spraying: Bordeaux mixture and Paris green as soon as the blossoms fall.

Third spraying: Bordeaux mixture and Paris green ten to fifteen days after.

## 6. GRAPES.

*Mildew, black rot and flea beetle.*

First spraying: Bordeaux mixture and Paris green when leaves one inch in diameter.

Second spraying: Bordeaux mixture and Paris green when flowers have fallen.

Third and fourth sprayings: Bordeaux mixture at intervals of ten to fifteen days.

Paris green alone when the beetle is attacking the buds in the spring.

## 7. RASPBERRY.

*Anthracnose, leaf blight and flea beetle.*

First spraying: Bordeaux mixture and Paris green just before growth begins.

Second spraying: Bordeaux mixture and Paris green about when first blossoms open.

Third spraying: Bordeaux mixture when the fruit is gathered.

## 8. CURRANT AND GOOSEBERRY.

*Worms and mildew.*

First spraying: Bordeaux mixture and Paris green as soon as the leaves expand.

Second spraying: The same ten to fifteen days later.

For worms alone, hellebore or Paris green will be effective.

## 9. TOMATO.

*Rot and blight.*

Spray with Bordeaux mixture, as soon as rot or blight appears, for three times, if necessary, at intervals of ten to fifteen days.

## 10. POTATO.

*Blight and beetles.*

First spraying: Paris green as soon as the beetles appear (one pound to 100 gallons of water).

Second spraying: Bordeaux mixture and Paris green when plants six inches high.

Third and fourth sprayings: Bordeaux mixture at intervals of ten to fifteen days, if necessary.

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## 11. CABBAGE.

Pyrethrum applied in solution (one ounce to four gallons of water) or dusted on (one part pyrethrum to seven parts flour) for the cabbage worm.

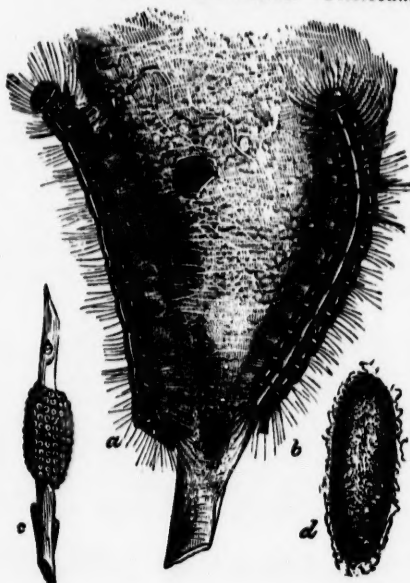
## 12. STRAWBERRY.

The rust or leaf-blight.

Bordeaux mixture when it can be applied without disfiguring the fruit will control this disease. Apply at intervals of two or three weeks on new buds after they begin to make runners.

## INJURIOUS INSECTS.

The following are some of the most common injurious insects that are troublesome in the garden and orchard. To destroy these, spraying as directed will be effective. To destroy insects use only an insecticide, but if treating for a fungoid pest at the same time use a combined fungicide and insecticide.

1. TENT CATERpillars.—*Clisiocampa Americana*, and *C. Sylvatica*.

Tent Caterpillar: a and b, caterpillars; c, egg cluster; d, cocoon.



Tent Caterpillar Moth.

These insects weave large webs in the branches of the apple tree and do much damage feeding upon the foliage of the trees. It also attacks the plum and cherry. The eggs—200 to 300—are laid in rings upon the twigs of the trees and can be readily seen, so that many of them might easily be destroyed during the winter. The caterpillars grow rapidly. *Americana* has a white strip down the back, and *Sylvatica* a series of white spots, and thus they are readily distinguished from each other. Both develop into brown moths.

The accompanying cut represents the different stages of the insects. *C. Americana*.



**Remedy.**—1. Collect the egg clusters in winter. 2. Crush the "tents" when full of caterpillars. 3. Apply Paris green with lime or with Bordeaux mixture.

### 2. CODLING MOTH.—*Carpocapsa pomonella*.

The eggs of this tiny moth are laid on the calyx of the young apple, while it is turned up. As soon as hatched the larva burrows into the apple, where it feeds until fully developed. Affected apples fall to the ground, and often contain the worm in them. The cocoons are frequently under the bark and in other sheltered spots.

The moth appears about the time the trees are in bloom, and is one of the worst pests that attacks the apple.

**Remedy.**—1. Feed to hogs the fallen apples which may contain larva. 2. Spray with Paris green, as directed for the treatment of the apple.



Codling Moth: a, burrow; b, entrance hole; d, pupa; c, larva; f, moth.

### 3. CANKER WORMS.—*Anisophteryx vernata* and *A. pometaria*.

The spring canker-worm was very common in 1896. Both worms are much alike, about an inch long, of a darkish brown color, slender, and move with a



Canker Moths: a, male; b, female.



Canker Worm (f), and eggs (a, b, c)

loop-like motion, hence, sometimes called "measuring worms." They can drop from a tree by a silken thread.

*A. vernata*, the imago, appears in spring; the female is wingless, the male is ash-colored and has wings. *A. pometaria* is much the same, but the imago

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appears in the fall. The wingless females in both species crawl up the trunks to lay their eggs upon the twigs.

These insects attack the plum, cherry and apple. The accompanying cuts illustrate *A. vernata*.

*Remedy*.—The females may be trapped by putting a band of some adhesive material around the tree.

2. Paris green is an effective remedy, as directed in the treatment of the apple.

#### 4. OYSTER-SHELL BARK LOUSE.—*Mytilaspis pomorum*.

This insect appears in the form of minute brown scale upon the bark of the apple tree, and being much the same color is difficult to distinguish. The eggs are beneath the scales. They hatch about the end of May or the beginning of June. The young lice are almost invisible; they suck the ends of the young twigs, where they become fixed, and continue to suck the juice from the twigs. Soon a scale forms over them. All under the scales, the shape of an oyster-shell, are females, that lay their eggs under the scale. The scale of the male is more oblong and is rarely seen.



Oyster-shell Bark-Louse.

*Remedy*.—1. In winter, or early spring, scrape off the rough bark from the trunk and large limbs, and rub in with a scrubbing-brush the following solution: One quart soft soap, or one-quarter pound hard, in two quarts boiling water; take seven parts of this and add one part carbolic acid; then, when the young lice are moving (May or June), spray with kerosene emulsion, diluted with ten parts water.

#### 5. PEAR TREE SLUG.—*Eriocampa cerasi*.

This insect may be found attacking the pear, plum and cherry.



Pear tree slug, various sizes.

The eggs are laid about June. The larva is about one-half inch in length and is thicker towards the head, of a somewhat greenish-black color and slimy. It has many legs. The pupa stage is spent in the ground and lasts two weeks. The imago is a small, four-winged black fly. The slug feeds on the upper surface of the leaf. It was quite common during 1896.

*Remedy.*—Spraying with Paris green, hellebore or pyrethrum, in the common proportions.

There is a second brood about the middle of July which is quite as destructive as the first brood. Spray with of Bordeaux and Paris green first week in June and middle of July.

#### 6. PLUM CURCULIO.—*Conotrachelus nenuphar*.

There is no insect better known than this little beetle. The egg is deposited in the plum, where it hatches. The affected fruit soon falls to the ground, and the larvæ leave the plums, pass into the ground, where they remain for about six weeks. The imago is a small grayish beetle, one-fifth of an inch long, with a black lump on the middle of each wing case. It has a curved snout and a stout body. The beetles hide themselves during the winter, in sheltered spots, and appear in spring about the time the trees are in bloom. This insect is also found upon the cherry, peach, and even apple. The curculio works on the fruit for about eighteen days only.

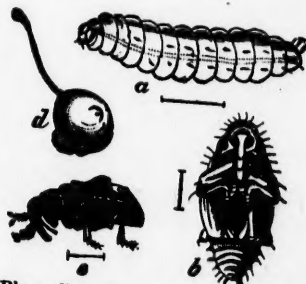
*Remedy.*—1. Jarring the trees morning and evening. At this time many beetles will drop and may be collected upon a sheet placed below.

2. Gather and destroy the affected plums, as they fall.

3. Spray Paris green as directed for the treatment of the plum, or Paris green may be applied alone (1 pound to 150 gallons of water, if the foliage is tender add 2 lbs. of lime). Spray once before the trees bloom, as soon as the foliage is well started, again as soon as the petals fall, and repeat about a week after.

#### 7. TO PROTECT THE PEACH TREE FROM THE BORER.

Take equal parts of hardwood ashes and fresh lime, add water until it has the consistency of paint; to this add one ounce of crude carbolic acid to each four gallons of the mixture. Apply with a brush to the trees from the limbs down to where the roots join the trunk. It is necessary to clear the ground away a little to make a perfect job. Apply last week in May.



Plum Curculio: a, grub; b and c, beetle; d, egg laying on plum.

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8. CURRANT WORM.—*Nematus ribesii*.

Currant Worms and the Saw Flies to which they change.

This insect is very troublesome upon currant and gooseberry bushes. It lays its eggs early in the spring, on the under side of the leaves, in rows along the veins. These hatch in about ten days, and the young worms appear. The larva, when full-grown, is about three-quarters of an inch in length, of a greenish color, with dark spots, and has many legs. It spins a brown cocoon, of paper-like texture, which is found sometimes on the ground among the dried leaves, or on the bush, attached to the stems or leaves. This represents the pupa condition.

The imago appears in about two weeks after the pupa stage has been entered. The male is much smaller than the female, the body black, with some yellow spots above, while in the female the body is mostly yellow. Both have four membranous wings. A second brood is of common occurrence.

**Remedies.**—1. Hellebore, one ounce in three gallons of water. It may also be applied as a dry powder, mixing it with three or four parts flour.

2. Paris green for the first brood, but care must be taken not to continue this if the fruit is likely to be affected.

### 9. GRAPE-VINE BEETLE.—*Haltica chalybea*.

The eggs are deposited on the under side of the leaves. The larva is about one-third of an inch long, brownish, with several black dots on the body. The pupa condition is passed in the ground, and continues for about three weeks.

The imago is a small, polished beetle, about one-fifth of an inch long. It passes the winter in sheltered spots, under leaves, or around the roots, and is very destructive in the spring to the young buds, and afterwards, in the larval condition, to the leaves.

**Remedies.**—1. Paris green, three ounces to fifty gallons of water, or combined with Bordeaux mixture as directed under treatment of the grape.

2. Dust pyrethrum powder upon the vines attacked.
3. Jarring the vines in the morning and collecting the beetles.

### 10. ROUND-HEADED BORER (*Saperda candida*).

The eggs are deposited about June, near the base of the trunk of the apple tree. The larva eats its way through the outer bark to the inner, and takes about three years to develop. It works in the sapwood, where it forms flat, shallow cavities, filled with sawdust-like castings. These are often seen on the bark, and indicate where the "borer" is at work. As it reaches maturity, it cuts a passage upwards into the solid wood, and then curves towards the bark



Round headed Apple Tree Borer, *Saperda candida*: a. larva; b. pupa; c. beetle.

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Apple Tree  
Borer, *Coccinella*: a  
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In this channel it enters the *pupa* stage, about spring. When fully developed, it is an inch long, with a round head that distinguishes it from the flat-headed borer, which also affects the apple tree.

The *imago* is a slender beetle, one inch long, with two broad, whitish stripes on the wing covers, and long jointed antennæ. It appears about June.

#### 11. FLAT-HEADED BORER (*Chrysobothris femorata*).

This insect also attacks the trunk of the apple tree, but lays its eggs higher up the tree than the preceding one. The *larva* is a pale yellow, an inch long, and has a well-marked flat head, much wider than the body. It is sometimes found even in the limbs, and is not so long in developing as the round-headed borer. It cuts flat channels in the sapwood, and sometimes girdles the tree. Castings and discolored bark indicate its presence. It finally bores into the solid wood, and becomes a *pupa* for about two weeks, and then emerges as an *imago* about half an inch long, somewhat flat, and of a greenish black color, with three raised lines on each wing-cover. The legs and under side of the body present a coppery lustre.

Flat Headed Apple Tree Borer, *Chrysobothris femorata* Fabr: a, larva; b, beetle.

2. About the beginning of June, apply the following mixture to the trunk of the tree:—One pound of hard soap, or one quart soft, in two gallons of water; heat to boiling, and add one pint crude carbolic acid; make a second application in three weeks. This can be well done by using an old scrubbing-brush to rub it in.

#### 12. BUD MOTH (*Tmetocera ocellana*).

This insect is found attacking the buds upon the apple, and sometimes proves very injurious. The half-grown *larva* winters over, and appears in spring as a small brown caterpillar, just about the time the buds begin to open, and feeds upon them. It measures about half an inch when full grown. By rolling up one side of a leaf, and securely fastening it with silken threads, it forms a tube in which it enters the *pupa* stage, having lined the little chamber with a closely woven layer of silk. This condition lasts ten days. The *imago* is a small moth, resembling the codling moth in size and form. It is of an ash-gray color. The front wings have a whitish gray band across the middle; the hind wings are a dusty brown. The expanded wings measure half an inch across.



Apple Tree Bud Moth, *Tmetocera ocellana*: a, moth; b, larva; c, pupa.

*Remedy.*—Paris green added to Bordeaux mixture as directed for the treatment of the apple.

### 13. THE GRAPE-LEAF HOPPER OR THRIP (*Erythroneura vitis*).

This small insect, about an eighth of an inch long, of a white color, marked by three dark bands, is sometimes troublesome on grape vines.

They feed upon the juices of the plant, and are usually upon the under-side of the leaves, where they are difficult to reach in spraying.

*Remedy.*—1. Remove fallen foliage at the close of the season, so that the insects cannot find shelter during the winter.

2. Spray with kerosene emulsion diluted with ten parts water, on the under side of the leaves in the cooler part of the day.

### 14. RED SPIDER (*Tetranychus telarius*).

The red spider is a very small insect—a true mite—and in some places is very destructive. It sucks the juices of the plants attacked, and causes the color of the leaf to change from green to a grayish white. It flourishes in a dry atmosphere and in sunny places; shade and moisture are not favorable to its development.

*Remedy.*—Spray with clear water, and keep the atmosphere about the plants moist.

2. Spraying with kerosene emulsion should also be followed by good results.

### 15. PLANT LICE (*Aphidae*).

These minute, greenish insects affect the foliage of many plants by sucking the juice, and thus injure the leaves.

They can be controlled by spraying with kerosene emulsion.

## INJURIOUS FUNGI.

The following are among the most injurious fungi that affect the products of the garden and orchard. They can be readily controlled by the proper application of Bordeaux mixture, as directed.

The usual life history of a parasitic fungus is, that it arises from a spore which is microscopic; this germinates and gives rise to thread-like structures which penetrate the plant upon which the fungus grows and derives its nourishment. Upon these structures in time spores are produced, as new sources from which the fungus may develop and continue to be injurious to the vitality of the plants attacked.



1. APPLE SPOT OR "SCAB" (*Fusicladium dendriticum*).

This fungus attacks the leaves and fruit of the apple, causing the "spots" on the fruit. The vegetative portion of the fungus is chiefly around the edge of the spots where the spores are produced in great numbers.

2. LEAF SPOT (*Entomosporium maculatum*).

This disease attacks the pear, causing the leaves to show reddish spots with small pimples in the centre. When the fruit is attacked it cracks and appears stunted.

3. "BROWN ROT" (*Monilia fructigena*).

Attacks plums, cherries and peaches. The fruit affected becomes brownish at first, then shrivels and appears dried. In this condition it is termed "mummified," and is often seen upon the trees in that form. All "mummified" fruit should be gathered and burned, as they contain spores that will perpetuate the disease.

4. "ANTHRACNOSE" (*Gloeosporium venetum*).

This fungus appears on the canes of raspberries as small round or oval patches, with a purple border, and sometimes upon the leaves as small yellowish spots with dark border. The affected canes should be cut out and destroyed by burning.

5. "LEAF-BLIGHT," "SUNBURN" (*Sphaerella fragariae*).

This disease produces very conspicuous spots on the upper surface of the leaves of the strawberry. The spots are reddish at first, then the centre becomes somewhat grayish.

6. "POWDERY MILDEW" (*Sphaerotheca mors uvae*).

This mildew is the well-known blight on the gooseberry. It thrives in a warm, dry atmosphere, and sometimes is very destructive.

At first the berries are covered with a grayish substance, and later assume a brown color.

7. "POTATO BLIGHT" (*Phytophthora infestans*).

This fungus attacks the potato, commencing with the leaves and finally affecting the tubers.

NOTES.

To prevent the drip reaching the hand, cut a hole through a piece of leather 4 x 4 inches, and run it up on the rod near the nozzle.

Use a Y and two nozzles, or a triple head and three nozzles. The work can be done just as well and much more expeditiously.

To keep Bordeaux mixture off horses and harness use coarse linen or other cover.



# PROVINCIAL EXPERIMENTAL SPRAYING.

Instructions are being given in the preparation and application of insecticides and fungicides at the following places for the season of 1897 :

## WESTERN DIVISION.

ST. THOMAS—Ernest Luntton's orchard.  
 BOTHWELL—A. O. Susser's orchard.  
 WALLACEBURG—Capt. J. W. Steinhoff's orchard.  
 SARNIA—John Davis' orchard.  
 LUCAN—W. E. Hooper's orchard.  
 KINCARDINE—Norman McPherson's orchard.  
 WINGHAM—G. Moffat's orchard.  
 ARTHUR—Wm. Cahalan's orchard.  
 ORANGEVILLE—D. McPheeter's orchard.  
 MILTON—Robert E. Harrison's orchard.

## CENTRAL DIVISION.

STONY CREEK—Robert Granger's orchard.  
 LYNDEN—B. Vansickle's orchard.  
 BURFORD—W. H. Lewis' orchard.  
 TILSONBURG—Jas Haney's orchard.  
 PORT DOVER—Geo. Dixon's orchard.  
 CALEDONIA—W. Richardson's orchard.  
 DUNNVILLE—John Taylor's orchard.  
 NIAGARA FALLS SOUTH—Thomas Smith's orchard.  
 ST. CATHARINES—A. Pay's orchard.  
 SMITHVILLE—George Adam's orchard.

## EASTERN DIVISION.

CLARKSON'S—O. G. Davis' orchard, one mile north of Lorne Park.  
 OSHAWA—R. J. Mackie's orchard.  
 PORT HOPE—E. Mitchell's orchard.  
 BRIGHTON—John Nisbett's orchard.  
 TRENTON—W. A. Warner's orchard.  
 CONSECON—Jas. L. Adams', S.B., orchard.  
 PICTON—J. P. Thorn's orchard.  
 PRESCOTT—George Bowyer's orchard.  
 SOUTH LANCASTER—Alex. Cameron's orchard.

— Cards giving the dates of the spraying at the several points may be obtained on application to the Superintendent. (W. M. ORR, Fruitland P.O.)